SPINOFF FROM A MOON BOOT

A new line of athletic shoes typifies aerospace technology derivatives for consumer, home and recreational use

The Apollo lunar suit worn by a dozen moonwalking astronauts was a masterpiece of design and engineering, a complex space system that included a built-in artificial atmosphere for breathing and pressurization, protection against temperature extremes, micrometeoroid shielding, eye protection against blinding glare and a score of other features intended to assure lunar mobility with safety and comfort. One little-known feature was use of a special three-dimensional "spacer" material in the lunar suit's boots for cushioning and ventilation. That material has turned up, in modified form, as the key element of a new family of athletic shoes designed for improved shock absorption, energy return and reduced foot fatigue.

Manufactured by KangaROOS USA, Inc., St. Louis, Missouri, the new line of shoes resulted from a two-year research and development program. The company sought to reduce athletic impact forces, which are transferred by the muscular-skeletal system through the foot and lower leg, and at the same time provide "medio lateral control" or lateral stability. The problem was that the two functions were inversely related—if conventional design techniques were employed, improving one would work to the disadvantage of the other.

The development effort involved KangaROOS High Performance Development Division, aided by consultants, and used as an informational base a study performed by NASA's Aerospace Research Applications Center, Indianapolis, Indiana. From this effort emerged the Dynacoil™ athletic shoe cushioning system, featuring a departure from conventional design that, says the company, not only reduces impact shock and provides the requisite lateral stability, but also contributes to increased athletic efficiency.

The mechanical core of the cushioning system is "Tri-Lock" three-dimensional space fabric; an advancement of the original lunar boot material, the woven fiber fabric includes a series of fiber coils as the third dimension. In the KangaROOS Dynacoil midsole design, the space fabric is encapsulated within a polyurethane foam carrier, which in turn is surrounded by a stable "motion control rim."

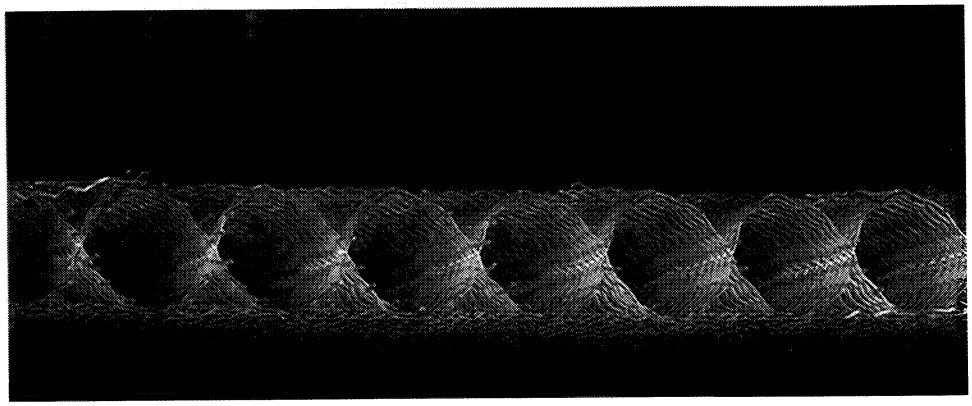
This design, says KangaROOS, produces a cushioning system that loses virtually none of its shock-absorbing capabilities throughout the life of the shoe. The Dynacoil midsole attenuates the pounding that accompanies running and court sports by virtue of the fact that the waves of interlocking fibers engineered into the space fabric spread the impact of foot strike over a longer time interval, greatly reducing impact forces. In addition, KangaROOS states, the midsole's exceptional resiliency helps cycle energy back into the athlete. The company explains:

"As the foot makes contact with the ground, the encapsulated space fabric is compressed. As the foot begins to reach the end of its stride, the heel-to-toe waves of fibers provide a rebound effect, producing upward force much

Team KangaROOS runners and Olympic milers John Walker and Ray Flynn are wearing a new type of athletic shoe that incorporates technology from lunar astronauts' boots.

like that of a resilient spring. The 'coiled energy' effect actually absorbs and redistributes energy back into the athlete with every step in a Dynacoil midsole. This energy saving adds to athletic efficiency and reduces foot fatigue."

Subjective wear tests by athletes and additional testing by independent biomechanic and exercise physiology laboratories support the company's claim that KangaROOS Dynacoil offers superior shock absorption, stability and motion control. KangaROOS plans a complete program of Dynacoil-based footwear to include running, tennis, basketball, aerobics, walking and cleated shoes, each product design-tuned—by scaling the shape and size of the fabric coils—to a specific sport and individual athlete. ▲



In the top photo are samples of KangaROOS shoes with Dynacoil midsoles designed to reduce user fatigue through improved shock absorption. The core of the cushioning system is a space-derived three-dimensional woven coil fabric shown in cross-section in the lower photo.

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